

March 4, 1990

FACT SHEET

For proposed approval to allow injection of restricted hazardous wastes into the following injection well(s):

Applicant: Hoechst Celanese Chemical Group, Inc.
Bay City Plant
Farm Road 3057
P. O. Box 509
Bay City, Texas 77414

Facility Location: Matagorda County

<u>Permit Number</u>	<u>Well Number</u>
WDW-14	2
WDW-32	3
WDW-49	4
WDW-110	1-A
WDW-277	5

Issuing Office: U.S. Environmental Protection Agency
Region 6
First Interstate Bank Tower
1445 Ross Avenue
Dallas, Texas 75202-2733

1. The Environmental Protection Agency (EPA) proposes to allow the injection of restricted hazardous wastes into the well(s) described above and in the petition demonstration document.
2. This fact sheet or similar statement of basis is required under Title 40 of the Code of Federal Regulations, §§ 124.7 and 124.8 (40 CFR §§ 124.7 and 124.8, as referenced by 40 CFR §§ 148.22 and 124.10).
3. The following is an explanation of the derivation of the proposed decision, which is categorized according to the criteria outlined in 40 CFR Part 148. [53 Fed. Reg., 28118, (1988)]

Summary

The EPA land disposal restrictions promulgated under § 3004 of the Resource Conservation and Recovery Act prohibit the injection of hazardous waste unless a petitioner demonstrates to the EPA that there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous. These no migration demonstrations include a description of the well operations, geologic siting, and waste stream characteristics. They also include modeling

strategies which incorporate all the above mentioned information and utilize mathematical equations to predict pressure build up and waste movement.

The Hoechst Celanese - Bay City petition described its well operation through a discussion of the well construction, well stimulations, injection pressures, and injection volumes. The site location and geologic conditions were presented through a discussion of the depositional environment, well logs, cross-sections, well tests, geologic maps, and well records. The characteristics of the injection wastestream were described and evaluated for compatibility with the injection and confining zones. Hoechst Celanese incorporated all this information into a modeling strategy which predicted the pressure build up and waste movement for the Bay City site. The waste plume, under worst conditions, was predicted to move laterally approximately 7.3 miles southeast in the upper interval and 6.6 miles southeast in the lower interval in 10,000 years. Vertical movement is approximately 128 feet. Both of these distances are within the injection zone.

In addition to the reasonably conservative data and assumptions in the no migration demonstration, the following factors augment the demonstration of no migration:

- (a) The petition over predicts pressure buildup and waste plume extent by modeling the injection rate at 750 gpm for the upper interval and 600 gpm for the lower interval which is more than the historic rate of 251 gpm for the upper interval and 190 gpm for the lower interval.
- (b) The petition over predicts the injected hazardous constituent concentration by assuming the constituent concentration is two orders of magnitude greater than the measured value.
- (c) The petition is reasonably conservative by not taking into account the degradation of the contaminant in the injection zone. Examples of degradation which were not considered are adsorption, oxidation, hydrolysis, temperature, and microbiological degradation.
- (d) In the evaluation of artificial penetrations, the petition does not take into account the natural occurrence of wellbore closure. This occurs within the Gulf Coast region due to the unconsolidated sediments.

Therefore, after a detailed and thorough review of the Bay City site petition, the EPA proposes that Hoechst Celanese has demonstrated, to a reasonable degree of certainty, that there will be no migration of hazardous constituents from the injection zone for a time period of 10,000 years.

The factors considered in the formulation of this proposed petition decision are described below.

Artificial Penetrations

The area around the Class I hazardous waste well cited in the petition must be evaluated to ensure that the injection activity will not endanger Underground Sources of Drinking Water (USDW) by causing movement of fluids into improperly sealed, completed, or abandoned wells. The petition applicant submitted information on all wells penetrating the injection or confining zones within 2.5 miles of the injection wells.

- (a) Artificial penetrations within the 2.5 mile radius are plugged or constructed to prevent the endangerment to an USDW.
- (b) There are 32 wells within the area of review (AOR) which meet this standard.
- (c) The calculated cone of influence (COI) is less than 1230 feet.

In addition to the nonendangerment standard, some artificial penetrations must also meet the no-migration standard. These artificial penetrations are wells which penetrate the injection zone and are located within the area of the waste plume movement over 10,000 years.

- (a) The artificial penetrations which penetrate the injection zone and are located within the area of the waste plume movement over 10,000 years are plugged or constructed to prevent the migration of hazardous waste from the injection zone.
- (b) There are 13 wells within the area of the plume which meet the no-migration standard.
- (c) All wells met this standard through a demonstration that waste movement due to pressure and molecular diffusion in an artificial penetration will remain within the injection zone.

Mechanical Integrity Testing (MIT) Information

To assure that the wastes will reach the injection zone, a petitioner must submit the results of pressure and radioactive tracer tests according to §148.20 (a)(2)(iv). A well has mechanical integrity when there is no significant leak in the casing, tubing, or packer, and when there is no significant fluid movement into an USDW through vertical channels adjacent to the injection well bore. The petition demonstrates that the active wells have been tested and do satisfy the above criteria.

<u>Well No.</u>	<u>Date of Pressure Test</u>	<u>Date of Radioactive Tracer Survey</u>
WDW-14	10-26-89	10-26-89
WDW-32	10-24-89	10-24-89
WDW-49	10-25-89	10-25-89
WDW-110	10-31-89	10-31-89
WDW-277	Not Drilled	

Injection well WDW-277 must meet the requirements of the Texas Water Commission injection permit. Results of the pressure and radioactive tracer tests must be submitted to the EPA Region 6 for approval prior to injection of restricted hazardous waste in well WDW-277. In addition, information obtained from the drilling and construction of the WDW-277 well shall be submitted to the EPA Region 6 to ensure the basis for the petition decision continues to remain valid. The information should include well logs, geologic core analysis of the confining and injection zones, a hydrogeologic compatibility determination, and formation tests.

Quality Assurance

According to §148.21 (a)(4), the Hoechst Celanese - Bay City petition demonstrates that proper quality assurance and quality control plans were followed in preparing the petition demonstrations.

Specifically, Hoechst Celanese has followed appropriate protocol in identifying and locating records for artificial penetrations within the Area of Review. Information regarding the geology, waste characterization, hydrology, reservoir modeling, and well construction has also been adequately verified or bounded by worst-case scenarios.

Regional and Local Geology

Class I hazardous waste injection wells must be located in areas that are geologically suitable. The injection zone must have sufficient permeability, porosity, thickness, and

areal extent to prevent migration of fluids into USDW's. The confining zone must be laterally continuous and free of transmissive faults or fractures to prevent the movement of fluids into an USDW and must contain at least one formation capable of preventing vertical propagation of fractures. The Hoechst Celanese-Bay City facility is sited in an area meeting the above criteria.

An evaluation of the structural and stratigraphic geology of the local and regional area has determined that the Hoechst Celanese-Bay City facility is located at a geologically suitable site. The injection zone is of sufficient permeability, porosity, thickness, and areal extent to meet requirements stated in 40 CFR Part 148. The confining zone is laterally continuous and free of transecting, transmissive faults or fractures over an area sufficient to prevent the movement of fluids into a USDW.

- (1) Depth of Confining Zone: 2350 feet
 Depth of Injection Zone: 2900 feet
 Depth of Injection Intervals: 3350-3600 feet
 5700-5950 feet
- (2) The geologic conditions were presented through a discussion of the depositional environment, well logs, cross-sections, well tests, and geologic maps.
- (3) The structure and isopach maps provided confidence in the geologic description.
- (4) The geologic cross-sections demonstrated that the injection zone is laterally continuous. This justified some of the modeling assumptions.
- (5) Pressure falloff tests support the injection zone permeability parameter in the modeling strategy.

Hydrogeology

According to §148.20 (a)(1), a petitioner must submit hydrogeologic information in order to study the effects of the injection well activity. Hoechst Celanese provided hydrogeologic information in the petition which demonstrates that USDW's are properly protected. The base of the lowermost USDW is at 1300 feet.

Characteristics of Injected Fluids

According to §148.22 (a), the characteristics of the injection wastestream must be adequately described in order to determine the wastestream's compatibility with the injection zone. These characteristics are described in the petition and the description is adequate and complete.

The waste contain the following EPA hazardous waste numbers: K009, K010, D001, D002, U001, U002, U031, U112, U123, U140, U154, U197, U226, F001, F002, Hexavalent Chromium

Geochemistry and Injected Waste Compatibility

According to §148.21 (b)(5), a petitioner must describe the geochemical conditions of the well site. The physical and chemical characteristics of the injection zone and the formation fluids in the injection zone were described in the petition. This description included a discussion of the compatibility of the injected waste with the injection zone.

- (1) The geochemistry of the injection zone was described through the use of core data.
- (2) Hoechst Celanese provided evaluations which demonstrated that the waste stream would not adversely alter the confining capabilities of the injection and confining zones.

Modeling Strategy

According to 40 CFR §148.21(a)(3), in demonstrating no-migration of hazardous constituents from the injection zone, predictive models shall have been verified and validated, shall be appropriate for the specific site and wastestreams, and shall be calibrated for existing sites. The modeling strategy consisted of a combination of analytical models. All the models used were identified as being verified and validated according to the information submitted in the petition. This information consisted of actual model documentation or references of methods or techniques that are widely accepted by the technical community. The petition describes the predictive models used and demonstrates that the above criteria are met.

According to 40 CFR §148.21(a)(5), reasonably conservative values shall be used whenever values taken from the literature or estimated on the basis of known information are used instead of site-specific measurements. Many variables were required to be quantified in order to employ the models used in the petition. All parameters were conservatively assigned to produce worst case conditions for either pressure buildup or waste movement.

According to 40 CFR §148.21 (a)(6), a petitioner must perform a sensitivity analysis in order to determine the effect of uncertainties associated with model parameters. Hoechst Celanese provided this sensitivity analysis in its petition. Through conservative model parameter assignments within this analysis, worst case scenarios for pressure buildup and waste movement were investigated and reported.

71.5

Results

1. Operational Life

Estimated Operational Life: Year 2000
 Maximum Permitted Injection Rates:

WDW-14	Combined annual
WDW-32	average of 750 gpm
WDW-49	in upper interval
WDW-110	Combined annual
WDW-277	average of 600 gpm
	in lower interval

Maximum Pressure Buildup [at wells]:

Upper interval	87 psi
Lower interval	86 psi

Maximum Lateral Waste Movement:

Upper interval	0.9 miles
Lower interval	0.8 miles

Maximum Vertical Waste Movement: <2.0 feet

2. 10,000 Year Post-Injection Period

Background Gradient or Velocity:

Upper interval	2.8 feet/year in southeast direction from site
Lower interval	3.2 feet/year in southeast direction from site

Waste Density Effects Yes x N/A _____
 Movement Due to Hydrocarbon Production Yes _____ N/A _____

X
 Maximum Waste Concentration Reduction Factor is 10^{-6}

Maximum Lateral Waste Movement:

Upper interval	7.3 miles in southeast direction from site
Lower interval	6.6 miles in southeast direction from site

Maximum Vertical Waste Movement is 128 feet in intact strata and 330 feet in mud.

October 3, 1991

FACT SHEET

For proposed approval of a reissuance of a previously approved exemption to the land disposal restrictions for the following injection wells:

Applicant: Hoechst Celanese Chemical Group, Inc.
Bay City Plant
Farm Road 3057, P.O. Box 509
Bay City, Texas 77414

Facility Location: Matagorda County, Texas
Permit Numbers: WDW-14, WDW-32, WDW-49, WDW-110, WDW-277
Well Numbers: 2, 3, 4, 1-A, 5

Issuing Office: U.S. Environmental Protection Agency
Region 6
First Interstate Bank Tower
1445 Ross Avenue
Dallas, Texas 75202-2733

1. The Environmental Protection Agency (EPA) proposes to approve a request for an exemption reissuance to increase the range of the specific gravity of the injected waste stream and to include an additional injection well.
2. This fact sheet or similar statement of basis is required under Title 40 of the Code of Federal Regulations, § 124.7 and 124.8 (40 CFR 124.8 and 124.8, as referenced by 40 CFR § 148.22 and 124.10).
3. The following is an explanation of the derivation of the proposed decision.

Summary

The EPA land disposal restrictions promulgated under § 3004 of the Resource Conservation and Recovery Act prohibit the injection of hazardous waste unless a petitioner demonstrates to the EPA that there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous. These no-migration demonstrations include a description of the well operations, geologic siting, and waste stream characteristics. They also include modeling strategies which incorporate all the above mentioned information and utilize mathematical equations to predict pressure build up and waste movement. Celanese successfully demonstrated no migration for the injection wells at the Bay City facility and obtained an exemption to the land disposal restrictions on May 4, 1990.

Celanese Bay City has requested to expand the specific gravity range for the waste stream injected into the Upper and Lower Miocene formations. The approved petition currently specifies that the specific gravity of the injected fluid must lie within the range of 1.0032 to 1.0054 at 68°F. The requested specific gravity range is 1.00 to 1.10 at 68°F. Celanese remodeled the plume movement based on the requested specific gravity range. This additional modeling indicated that the plume would move farther during the 10,000 year time period than indicated in the original model. For this reason, an exemption reissuance is required instead of a modification. Therefore, all aspects of the petition are open to public comment.

As part of the exemption reissuance, the Bay City Plant also requested to add an additional well, WDW-277, to the Petition Exemption. This well, if drilled, would be located near WDW-110 and also inject into the Lower Miocene Formation. Injection rates for the Lower Miocene Formation are restricted to a monthly cumulative maximum average injection rate based on 400 gallons per minute. All aspects of modeling and operation for this well were covered in the original no migration demonstration.

The waste stream in the reissued petition will be identical to the injectate in the original petition in every respect except specific gravity. Therefore, there will be no change in molecular diffusion rates of individual constituents in the waste stream, or in the compatibility of the waste with the formation or formation fluid. The non-endangerment standard demonstrated in the initial petition will still be valid for vertical waste movement.

Celanese Bay City demonstrated that increasing the specific gravity range for the waste stream would result in no migration of hazardous constituents from the injection zone for a 10,000 year period, as required in 40 CFR Part 148. Based on the remodeling for the reissuance request, the maximum updip plume movement did not change. However, this modeling resulted in an additional downdip plume movement of approximately 6300'. The expanded plume area was reviewed with respect to the geology and to determine if any additional artificial penetrations will be encountered by the plume. The artificial penetration review was performed based on the specific protocol that is defined in the reissuance request. Only one additional well was identified within the plume area. This well was properly plugged to prevent migration of waste from the injection zone.

Therefore, the EPA is proposing to change the Petition Approval Conditions as shown below. (All additions have been underlined).

1. This exemption is for the four existing injection wells WDW-14, WDW-32, WDW-49 and WDW-110. The exemption also includes WDW-277. All wells were permitted by the Texas Water Commission.

2. Injection of restricted waste shall be limited to the injection intervals for the following wells:

Well No. WDW-14	3350 to 3600 feet. (log depth)
Well No. WDW-32	3350 to 3600 feet. (log depth)
Well No. WDW-49	3350 to 3600 feet. (log depth)
Well No. WDW-110	5700 to 5950 feet. (log depth)
Well No. WDW-277	<u>Equivalent interval to 5700 to 5950 feet in WDW-110</u>

These injection intervals occur in an injection zone occurring at a depth of 2900 feet to 6200 feet (log depth).

3. The cumulative monthly volume injected in WDW-14, WDW-32, and WDW-49 shall not exceed 33,480,000 gallons. The monthly volume injected in WDW-110 alone shall not exceed 26,784,000 gallons. The cumulative monthly volume injected in WDW-110 and WDW-277 (if drilled) shall not exceed 17,856,000 gallons.

4. The facility shall cease injection of restricted hazardous waste by December 31, 2000.

5. The characteristics of the injected waste stream other than specific gravity shall at all times conform to those of Section 2.1 in the petition. The specific gravity of the waste stream shall remain within a range of 1.00 to 1.10 at 68°F inclusive.

6. The final approval for injection is limited to the following hazardous wastes: K009, K010, D001, D002, U001, U002, U031, U112, U123, U140, U154, U197, U226, F001, F002, Hexavalent Chromium.

7. Hoechst Celanese must petition for approval to inject additional hazardous wastes which are not included in Condition No. 6, above. Hoechst Celanese must also petition for approval to increase the concentration of any waste which would necessitate the recalculation of the limiting concentration reduction factor and the extent of the waste plume. Petition modifications and reissuance should be made pursuant to 40 CFR 148.20 (e) or (f).

8. Hoechst Celanese shall annually submit to EPA the results of bottom hole pressure surveys for WDW-14, WDW-32, WDW-49, WDW-110, and WDW-277 (if drilled). These surveys shall have been performed after shutting in each well for a period of time sufficient to allow the pressure in the injection interval to reach equilibrium, in accordance with 40 CFR 146.68 (e)(1). This annual report should include a comparison of reservoir parameters determined from the falloff tests with parameters used in the approved no migration petition.
9. Upon the expiration, cancellation, reissuance, or modification of the Texas Water Commission's Underground Injection Control permit for Well Nos. WDW-14, WDW-32, WDW-49, WDW-110, and WDW-277 (if drilled) this exemption is subject to review. A new demonstration may be required if information shows that the basis of granting the exemption is no longer valid.
10. Injection well WDW-277 must meet the requirements of the Texas Water Commission injection permit. Results of the pressure and radioactive tracer tests must be submitted to the EPA Region 6 for approval, and if approved, the exemption will become effective and Agency authorization to begin injection of restricted hazardous waste in the WDW-277 injection well will be issued.
11. Information obtained from the drilling and construction of the WDW-277 injection well shall be submitted to the EPA Region 6 to ensure the basis for the petition approval continues to remain valid. This information should include well logs, geologic core analysis of the confining and injection zones, a hydrogeologic compatibility determination, and formation tests.
12. The drilling mud used in the drilling process of the WDW-277 injection well shall be properly disposed.